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# MEASURING THE RECREATION USE OF NATIONAL FORESTS

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THIS REPORT analyzes the problem of measuring recreation use of the national forest, with emphasis on the situation in California, describes the preliminary findings of current investigations, and proposes a program of further research. As a problem analysis, it is the first product of a new forest recreation research program begun at the Pacific Southwest Forest and Range Experiment Station in 1960.

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U.S. DEPARTMENT OF AGRICULTURE, FOREST SERVICE
Pacific Southwest Forest and Range Experiment Station
Berkeley, California

# MEASURING THE RECREATION USE OF NATIONAL FORESTS

By

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Ernest M. Gould, Jr.
Richard L. Bury

## INTRODUCTION

In recent years recreation has become an increasingly important product of the National Forests, and the problem of measuring its output has received correspondingly greater attention. But measurement is complicated by a characteristic that distinguishes all aspects of recreation from other forest products, namely: recreation is a consumers' good, while timber, water, and forage are producers' goods. "Consumers' goods" and "producers' goods" are simply terms that help to express the idea that recreation directly satisfies a human want. The other products require further processing to change trees into houses, water in-the-stream into water in-the-glass, and grass into meat on the table before they satisfy anybody's need for shelter, water, and food.

Measurement is further complicated because recreation is produced and consumed instantaneously on the site. Just as "beauty is in the eye of the beholder," so recreation is in the perception of the recreationist. At no time does recreation itself appear in a concrete and measurable form.

Because outdoor recreation has this intangible quality and usually is not marketed, land managers have developed practical measures that they assume are correlated with the recreation realized from an area. The most generally accepted criterion is the amount of use that people make of recreation areas and facilities.

Use can be measured in several ways, and the Forest Service has settled on three units of measure that have proved helpful over the years. The individual visit is the main unit for measuring the annual flow of people to each recreation site and area within a national forest. Length of stay is also valuable to clarify another facet of the kind of use made of these facilities. Finally, both measures

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1/ Formerly statistician at the Pacific Southwest Forest and Range Experiment Station, Mr. Marcus is now a member of the faculty of the Department of Statistics, Kansas State University, Manhattan.

are combined into man-days to express the total use at each place. These data are compiled annually and reported on Form 2300-1. (See Appendix)

Besides collecting use data, forest officers completing Form 2300-1 are also asked to divide visits among recreation activities. To avoid gross duplication, they assign each visit to the one activity--swimming or hunting, for example--that they think was the "primary purpose" of the visit. Although this information may be useful, the problem of allocating visits to "primary purpose" is not characteristically one of measurement and therefore is beyond the scope of this discussion.

If funds were unlimited, collecting data would be simple: just count the people and keep tab on how long they stay in each recreation area. Unfortunately, such an easy solution is seldom possible. Funds for this purpose are limited, many sites are small and widely scattered over a ranger district, and people move freely about the forest without passing entrance gates or paying fees for use of the area. Consequently, yearly use figures are estimated in ways suited to the various circumstances found on a district. To harmonize counting procedures, recreation areas and the various units of measure have been carefully defined in the Forest Service Handbook, along with suggested methods for collecting data. However, the need to improve the precision and efficiency of these procedures is widely recognized among recreation specialists. A prime need is for figures of known accuracy, collected in such a consistent way that trends over the years can be determined with reliability.

This paper reports the results of an exploratory study made to open up the whole field of measuring recreation to further and more basic research. Emphasis is placed on two aspects of the general problem: First, the various opportunities that forest officers now have for getting data on recreation use and possible new methods that, after further testing, may prove useful. And, second, an outline of additional studies that seem desirable to guide administrative selection of a satisfactory final solution.

## MEASUREMENT METHODS

Because national-forest officers have been collecting statistics on recreation use for many years, they have an intimate grasp of the inherent problems. Many of them have thought out and tested new systems. Consequently, at an early stage in this study a memorandum was sent to the national-forest supervisors in California and to regional foresters throughout the Forest Service asking for "suggestions for mechanical devices, methods and procedures, and techniques which might make the job of counting easier or more efficient." The replies, from 7 of the 10 regional foresters and from 11 of the forest supervisors in California, defined the existing array of collection methods and uncovered a number of innovations that have worked well in specific situations.

To get first-hand information, seven of the California national forests were visited. Counting techniques were discussed with forest

staffs. Finally a search was made for new devices and techniques. State of California and University of California workers concerned with similar problems--particularly those working in traffic engineering and wildlife management--were consulted. Professional journals, trade catalogs, and other pertinent literature were searched for information, and descriptive material was requested from manufacturers of useful devices.

Currently used or proposed methods that were evaluated with the help of these sources of information are of three types: self-counting, direct-counting, and indirect-counting systems (table 1). They differ not only in accuracy and consistency, but also in labor and cash costs. In general:

> The cheapest methods are self-counting systems, in which recreation seekers themselves report their use of facilities. These methods, however, require special circumstances for reliable results.
>
> Direct counting by personal observation may not be costly if done in slack periods or in the course of regular work, but may be expensive if someone must be hired simply to do this job. Recording aids and properly designed sampling may cut labor costs and improve accuracy.
>
> Indirect, mechanical methods of estimating recreation use have not been tried extensively. They promise lower labor costs in return for a somewhat higher initial investment than direct methods. Some indirect methods also have distinct possibilities for improving the accuracy and consistency of recreation-use data.

## SELF-COUNTING SYSTEMS

The results of self-counting methods are strongly affected by the degree of supervision and control associated with each. Records obtained from permittees are thought to be, on the whole, very satisfactory. On the other hand, records volunteered by individuals are often so variable that they are considered almost useless. The costs are generally minimal for any of the self-counting methods, but a slightly larger expenditure may be justified when it can increase the accuracy and consistency of some of these methods.[2/]

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2/ In all cases, where identical information is solicited from ten or more persons, questionnaires and survey plans must be cleared by the Bureau of the Budget under the Federal Reports Act of 1942 (56 Stat. 1078). Usually, clearance can be obtained readily if questionnaires are well designed and if survey plans do not duplicate other information-gathering activities.

Table 1.--Provisional evaluation of measurement methods

| Methods | Estimated accuracy | Estimated consistency | Estimated cost | Measures taken[1] |
|---|---|---|---|---|
| **Self-counting Systems** | | | | |
| Special Permits: | | | | |
| Organizations | High | High | Low | V,M-D,L/S |
| Special permit areas | High | High | Low | V,M-D,L/S |
| Modified fire permits | (Rating depends on further tests) | | | |
| Concessionaires | High | High | Low | V,M-D,L/S |
| Summer Homes | Med-Hi | Med-Hi | Low | V,M-D,L/S |
| Individual registration: | | | | |
| Camp registration boards | Med. | Med. | Med. | V,M-D,L/S |
| Guest books | Variable | Variable | Low | V,M-D,L/S |
| **Direct-counting Systems** | | | | |
| Full-time enumeration | Ratings depend on statistical control & recording aids | | | V,M-D,L/S |
| Part-time enumeration | | | | |
| Camera and TV observation | Values are largely experimental to date | | | |
| Aerial photography | | | | |
| **Indirect-counting Systems** | | | | |
| Foot traffic counting | Ratings depend on further tests | | | V,M-D |
| Vehicular traffic counting | | | | V,M-D |
| Use of selected services | | | | M-D |

1/ Indicates the recreation use measure most readily calibrated by each method: Visits, Man-Days Use, Length of Stay.

## Special Permits

### Special Permits--Organizations

Annual reports are requested from organizations, such as the Boy Scouts, that receive special permission to use a designated recreation site. Forest personnel have confidence in the correctness of these figures. Such reporting is an inexpensive way to measure the number of visits, length of stay, and man-days of use made of organized group facilities. Usually, simple periodic spot checks are all that are needed to

insure continued accuracy. However, the opportunities to get use-data in this way seem limited to responsible, organized groups. It is also likely that the accuracy of reports will diminish if any additional information is requested that is not readily available within the organization. If necessary, accurate reporting might be enforced as a condition of permit issuance.

Special Permits--Selected Areas

Because of local conditions, some national-forest areas require a special permit of people who wish to enter; the San Jacinto Wild Area in the San Bernardino National Forest is an example. The permit provides statistical information about use of the area. A technique of this type may have wider application for gathering data about the use of other back-country recreation areas. Establishing the custom of obtaining a special fire permit or entry permit for wild, wilderness, and perhaps some other recreation areas may also have value entirely aside from the use data gathered. People might be better distributed over the area, accidents prevented by timely advice, and, if more rigid control is ever needed, the transition would be easier.

Special Permits--Fire

An interesting possibility for gathering recreation-use data is presented by the fire permits required of almost all picnickers and campers in the national forests of California. Although the seasonal permit presently used cannot directly provide data for form 2300-1, useful subsidary information is or could be recorded on the stubs and systematically analyzed. If a punch card were used as a stub, machine methods could easily summarize the origin of applicants, area first used, equipment owned, etc. The collected stubs could also define a population of recreationists from which a random sample could be selected for questioning. This is now done with California hunting license receipts. More information is presently gathered on fire permit stubs than in any other formal way, but little use is now made of these data.

If the procedure were changed to require a new permit for each visit, then much of the recreation-use data needed for form 2300-1 might be gathered from this source. Forest officers estimate that as much as 40 percent of the parties who should obtain permits do not do so at present, so a sample check of users would be necessary to derive adjustment factors unless the permit system is more rigidly enforced.

Special Permits--Concessions

Some of the larger national-forest recreation facilities are operated by concessionaires who charge a fee for camping, picnicking, use of tows, launching ramps, or other facilities. Concessionaires have a good chance to derive use-data from their receipts, registration cards, tickets, and contacts with users. At some such facilities the operator is now depended on to count use; at other places, forest personnel make counts. The concessionaire may or may not keep track of picnickers

and campers separately, or length of stay. However, collecting these data could be required in the contract for the special-use permit, and it should be a simpler matter to measure use where fees are paid than in free areas.

### Special Permits--Summer Homes

At least one annual contact is made with the owners of summer homes on national-forest land, usually at the time fees are collected. At present the characteristics of this kind of use are not well known and use-data are gathered in several ways. In some forests, a questionnaire is sent to each resident; in others formal and informal personal contacts by forest officers are depended upon to get an estimate of use. A questionnaire with the yearly bill seems to be the easiest way to collect information, and a follow-up sample count could be made as a check.

## Individual Registration

### Campground Registration Boards

Another form of self-counting results as a by-product of regulating the use of some of the larger campgrounds. Registration boards are put up at entrances, and the camper is asked to fill out a card and place it in the slot on the board which represents the family unit he will occupy. When he leaves, the cards are supposed to be removed and put in a box for later collection. The cards help show the new arrival which units are unoccupied, they help locate parties in case of an emergency, and they can provide recreation-use data.

Registration boards work best, of course, when they are conveniently placed, kept in good repair, and adequately supervised to see that all parties fill out cards correctly, remove them on leaving and do not use the cards to reserve sites they do not actually use. Picnic use of campgrounds may have to be estimated separately because picnickers normally do not use the registration boards.

Number of campers, length of stay, and man-days of use can be derived by analyzing such registration cards. Machine methods could be used to compile the data. However, spot checks are needed to get good compliance and reasonable correction factors. Patrol counts are usually used to supplement the data collected from cards.

The National Park Service has estimated that about 10 percent of overnight visitors in Yosemite Park do not register at the boards provided. The proportion of non-registrants at board-serviced campgrounds on the national forests is not known. Checks at two campgrounds in the Sierra National Forest, before and after July 4, 1960, gave the following results:

| Little Denver Church Campground | July 2 | July 3 | July 6 |
|---|---|---|---|
| Time of day | 2400 | 1330 | 2145 |
| Number of family units available | 10 | 10 | 10 |
| Number of registration slots filled | 10 | 10 | 10 |
| Number of car licenses reported | 6 | 6 | 10 |
| Number of parties actually present | 3 | 3 | 10 |
| Number of cars in campground | 13 | 15 | 15 |
| **Big Denver Church Campground** | | | |
| Time of day | 0025 | 1355 | 2210 |
| Number of family units available | 40 | 40 | 40 |
| Number of registration slots filled | 40 | 40 | 37 |
| Number of car licenses reported | 31 | 31 | 33 |
| Number of parties actually present | 17 | 13 | 17 |
| Number of cars in campground | 52 | 52 | 38 |

At these two campgrounds about half of the parties who filled out cards were at the stated sites. Several of the same parties were counted on all these dates; apparently, they had remained in the campground throughout the 4-day period.

### Individual Registration--Books

Another method of getting people to count themselves is by maintaining visitor registration books at campgrounds, fire lookouts, points of special interest, and the like. Theoretically, the number of visits, length of stay, and man days of use can be recorded directly. Registration books work well only at points where registration makes sense to the visitor or where he wishes to record his presence because it indicates achieving some goal. Unless someone is present to urge and supervise the use of the book, the registration data may be unsatisfactory because of unrecorded visits, partial records, misinformation, and vandalism. Periodic checks may minimize some of these shortcomings, but generally they cannot be overcome by any effort less than full-time supervision of the registration process.

## DIRECT-COUNTING SYSTEMS

On the national forests, the most common system of collecting recreation-use data is to have forest personnel make special counts at recreation sites. The problems that characterize this system depend, in the first place, on whether counts are made on a full-time or part-time basis. Full-time attendants, whose principal duties are maintenance or supervision of use, usually can count all visits and record length of

stay. Both measures of use can be recorded with about equal ease; the main difficulty is doing this census work efficiently. Although full-time counts may be made at only a few places, these usually include the most heavily used areas on the forests.

Almost all developed recreation sites on the national forests are visited periodically by forest personnel for clean-up and inspection purposes. The bulk of the current estimates of use are based on part-time counts made in the course of this work--counts which measure occupancy of the site rather than visits or length of stay. The efficiency of this procedure depends on effective sampling and on accurate conversion and expansion factors to derive reliable estimates of number of visits and length of stay.

Various mechanical aids can help speed up direct counting and improve accuracy. The major possibilities are listed below (additional information is summarized in the appendix):

1. Portable, battery-operated tape recorders can be used in the field to record data rapidly for later office analysis. Counts of people in vehicles or campgrounds, time of entry and exit, license numbers, and the like can be accumulated by one man working alone (5).

2. Counts or other observations that can be coded may be put on punch cards in the field for later machine analysis. Mark-sense cards can be marked with a special pencil and later punched automatically. Pre-perforated, "Port-A-Punch" cards can be punched in the field with a pencil-like stylus while the card is held in a plastic box (9).

3. Hand-operated mechanical talliers record up to 10,000 items. These counters come in single units or combinations of 2 to 72 units mounted in banks. A 4-unit system, for example, can record the number of vehicles, people, trailers, and boats seen in a campground or passing a check point (10).

## Census Counts

With full-time attendants, sampling problems may largely disappear. For example, at one national-forest campground in California, the attendant lives in the area and records the license numbers of cars on the site each day and the number of children and adults in each group. The license numbers are noted to enforce a two-week camping limit, but they also show the presence of a vehicle and party for one or more days. Thus visits, man-days, and length of stay are all determined from the attendant's records. Some picnickers may be missed, but this site is remote enough to reduce the likelihood of day use.

On many ranger districts, special census forms are used to increase the accuracy of reports and promote consistent measuring. Some forms are quite elaborate and gather such information as the origin of the party and the camping equipment used. Some provide for recording interviews to determine the purpose of the visit. Other districts have

Portable tape recorder and other equipment used for recording cordon count of vehicles.

Operating a cordon-count station at winter sports area in the High Sierra.

used special forms at one time and later abandoned them. Others may fill out their own forms quite carefully but then find the compilation job too big to handle.

In some situations even a full-time attendant cannot take a complete census of use. Counts of visits to picnic and swimming areas with a high peak volume of visits and a rapid turn-over rate, for example, may be more than one man can handle. Even convenient forms and mechanical aids to counting may not simplify collection enough so that the attendant can do his work properly. In such instances sample counts must be made; indeed, if properly done, they are a better base for estimating recreation use than an unreliable census.

## Sample Counts

The timing and frequency of sample counts are important considerations because the use of recreation facilities is known to vary hourly, daily, and seasonally. Expanding successive mid-week counts could underestimate total use; relying on high week-end counts alone could overestimate

weekly use. Usually sites can be checked only as often as maintenance is required--several times a day in heavily used areas, or only once a week at more inaccessible, lightly used sites. Thus, when counting is combined with maintenance, the time and number of counts are likely to be governed by maintenance needs, and not by the requirements of sampling. This may introduce a sample bias.

Some ranger districts recognize this problem and try to make counts at the same time each day; others attempt to randomize the time of counting. Any final decision on when and how often to count depends on improved information about the seasonal, daily, and hourly patterns of recreation use. Although random counts tend to eliminate sample bias, greater economy may be achieved if patterns can be established to stratify periods of use before sampling. Double sampling also promises some economy and improved reliability.

Various things are presently counted to indicate visits, especially in campgrounds. People or beds may be counted, or campsites or automobiles may be tallied and later converted to visits. "Eye estimates" are sometimes used. For example, a guard who knows the capacity of a facility and has counted it frequently may produce an estimate of occupancy after a tour through the site without actually counting the people. Study is needed to determine the accuracy and consistency with which the various items are counted and the relationship of each to the standard measure of recreation use.

Converting factors to change car or party counts to visits are determined in a number of ways. Sample counts may be used, that is, the number of persons in a hundred cars as determined once or twice a season. Factors may be "handed down" from previous rangers who made counts, or factors may be "borrowed" from some agency that has made a study. Separate factors are seldom determined for separate times (week-days, week-ends, and holidays) or for separate groups (camping parties, picnic groups, hunters). Although size of party may not vary significantly over time or by group, this point has not been thoroughly investigated.

Maintenance men and patrolmen can readily count the people present when they visit a recreation site. They can also note evidence of use, such as camping gear. However, determining how long the people stay is more difficult. Frequently an assumption is made. For instance, if a campground is counted at 8:00 a.m. it is usually assumed that all campers were there overnight and have used the site for one day. Sometimes the stay of recognizable parties may be used as a guide, or sample families may be questioned to find out how long they remain. Frequently a patrolman may "know" from experience the average length of stay in his camp or picnic ground. Sometimes the average length of stay as determined at sites with full-time attendants is applied to other similar areas. Although a variety of methods can be, and are, used to determine length of stay, further study is needed to determine the direction of bias, if any, and possible improvements.

Sampling is the key to increasing the accuracy and consistency and reducing the cost of direct-counting systems. Sampling is also

Time-sequence camera ready for operation at a ski lift. Single frames of movie film are exposed by a battery-operated solenoid.

central to deriving reliable conversion and expansion factors. Other basic problems of measures and standards are discussed later in this paper.

## Television and Camera Observation

Two machines offer interesting possibilities for more or less direct counts with considerable labor saving. Closed circuit television could be set up at entrances or exits on roads, trails, or other check points so that several locations could be observed at a central office. Small television cameras adapted to outdoor use at remote locations are available and monitoring can be done by eye, or the impulse can be put on tape, or the screen can be photographed.

Automatic cameras can also be set up to record for a considerable time, either continuously or at selected intervals of time. These cameras

can take pictures of persons breaking a beam of light, activating a treadle, or crossing some other detecting device (3, 8). Other data, such as date and time, can be recorded simultaneously. Night pictures can be taken with infra-red light. Some of these devices are also used for traffic counting.

Both of these machines are limited by set fields of vision, light conditions, and other factors, and are best adapted for sample counting. They do have some possibility for measuring length of stay or direction of movement. The license plate numbers shown in successive photos of a parking lot would indicate how long the cars stayed, for instance. The practical application of these devices for gathering recreation-use data is still to be worked out.

### Aerial Observation

Recreation areas can be observed from the air and recreationists, their cars, tents, trailers, boats, and campsites counted or photographed for later compilation and analysis. Light airplanes or helicopters are adaptable to this procedure and have been extensively used in wildlife management for animal census work (4, 6, 7, 2). Vertical or oblique aerial photos, and steroscopic pairs of aerial photos can be used. Black and white, color, and infrared films offer further possibilities. Field trials in the summer of 1960 have brought out some of the more important specifications for flying aerial photography of a wooded campground.3/

## INDIRECT-COUNTING SYSTEMS

Several devices are capable of automatically counting people, vehicles, or the use of selected facilities at recreation sites or areas. Little labor is required beyond that necessary to install and maintain the machines and to read the results. However, conversion factors are needed to derive the usual estimates of recreation use from the items counted. Some of these devices are fairly expensive and require elaborate installation while others are cheap and easy to use. Altogether, they offer a wide variety of possibilities for gathering recreation-use data with a minimum of labor.

### Foot Traffic Counters

Wherever the users of recreation areas can be channeled to walk through an entrance or exit, or along a trail, they can be counted. Turnstiles and stiles can be equipped with simple tallying devices actuated by a revolution of the turnstile or pressure on a step. Totals can be read periodically to keep track of the flow of people in any time unit desired.

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3/ Colwell, Robert N., and Marcus, Leslie F. Developing aerial photo specifications for estimating the intensity of recreational use in wildland areas. (Presented at March, 1961 annual meeting of American Society of Photogrammetry and submitted to Photogrammetric Engineering for publication.)

Unfortunately these devices are a favorite butt of miscreants who repeatedly spin the turnstile or step up and down on stiles, exit through entrances, and the like. This trouble is reduced, but not necessarily eliminated, by concealing the counting device and making entrances and exits logical and convenient. A certain number of people will nonetheless avoid the device, so some checking is needed to correct the recorded count. In addition, other data will be needed to determine the length of stay and convert visits to man-days.

Several of the vehicle traffic counters discussed later can be converted to count people. These devices require the same steps just mentioned to correct counts and convert them to other measures. It should be noted that the corrections needed and the conversion factors required are likely to be different for each installation and may have to be individually calibrated.

Automatic cameras can be set up to be tripped by any of these devices and may provide some useful extra data. Photos may also help disclose vandals and otherwise aid in interpreting the counts.

## Vehicle Traffic Counters

Several national forests in California now use cumulative, pneumatic, traffic counters to record traffic on forest roads, or obtain counter readings from the State Highway Department or other agencies. These counts are taken on access roads to the forest, occasionally at the entrances to large campgrounds or picnic areas, or on one-way roads into areas used exclusively for recreation purposes. Some counters are read at a set time; others are read whenever it is convenient. A variety of forms have been developed for recording traffic counts systematically. These data are used directly for campground and picnic statistics only when the counter is on an entrance road to such an area, or on a one-way road leading into the area.

Although the portable, pneumatic machine that counts axles is the cheapest and most widely used type, there are several other kinds of traffic counters. Most of these cost considerably more, are permanently or semi-permanently installed, and require 115 volt electric current. But some of these permanent devices could be used to advantage if continuing measurements can be justified. They include machines activated by vehicles interrupting a photoelectric, radar, or ultrasonic beam so as to count the metal objects that pass by or under them. One electro-magnetic machine, activated by the magnetic field of a motor passing over a detector buried under the road, is the only device that counts motors without counting trailers.

Several problems common to all traffic counters may limit their usefulness in forest recreation administration or require special compensation:

Directional-flow traffic counter using special pneumatic tubing--ready for operation.

1. Traffic direction usually cannot be recorded unless the road is divided into lanes or is one-way. However, one special pneumatic counter can record traffic in one direction only even on narrow roads; one pneumatic and one electrical counter can separate traffic directions and also give total traffic.

2. Non-recreation traffic must be separated by subsampling the traffic stream or by placement of the counter so as to eliminate the non-recreation traffic.

3. A given vehicle may be counted several times during a single recreation visit.

4. Vehicle counts must be converted to total number of people; sample counts of party size per vehicle must be made.

5. Vandals may confuse the counts, steal, or damage the machines.

In addition to these general problems, pneumatic counters have some special limitations:

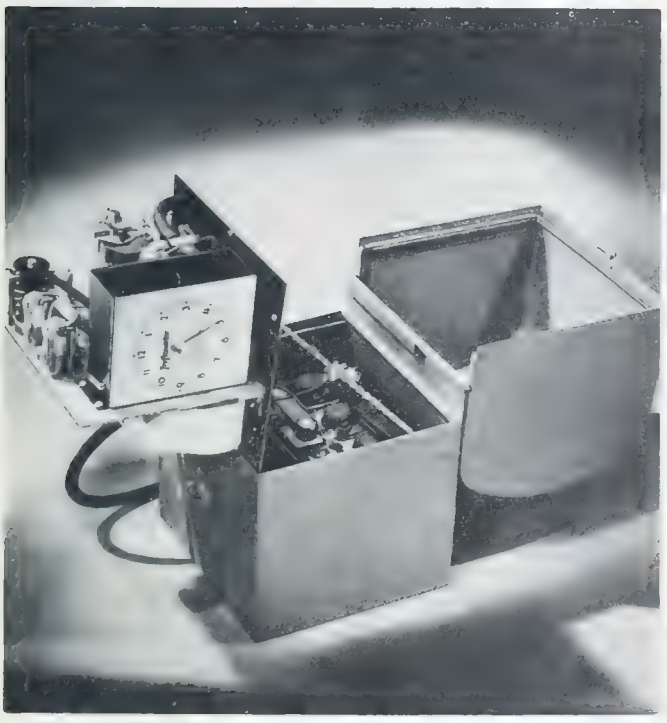
1. Axle counts must be converted to vehicles. Trailers may activate counters and result in overestimating number of cars, and small cars or motor scooters may be missed.

2. With pneumatic counters a smooth, hard-surfaced road is desirable; counts on unsurfaced roads may be unreliable.

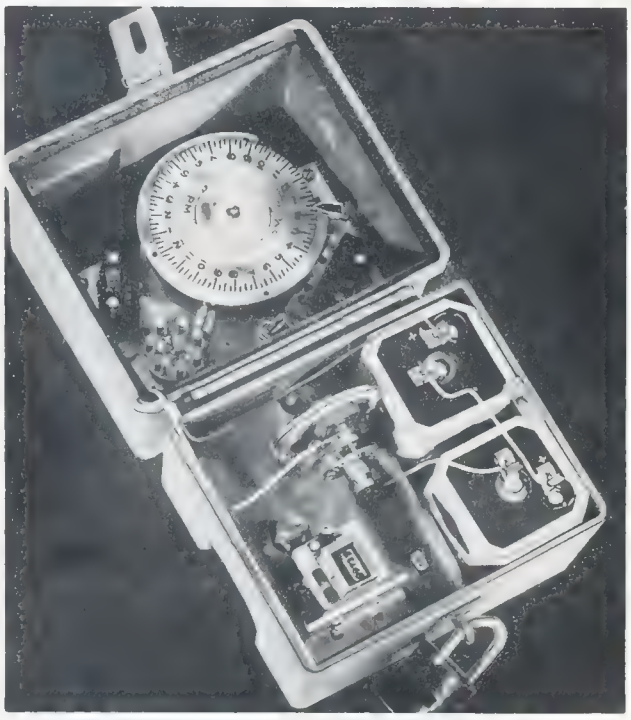
3. Ice and snow may interfere with the count, and snow plows may dig up the rubber hoses.

Several kinds of count-recording mechanisms can be used with the various activating devices. The simplest is a five digit cumulative tally. A more complex device prints the hourly or fifteen minute accumulations on paper tape. A variant of the latter inks the results on a circular one-day or one-week graph to picture traffic flow variation. Another device cumulates counts during preset hours and days so as to sample traffic density. A machine also can be installed to signal counts to a central control station. And, of course, any tripping device can be attached to a camera to photograph the vehicle. Ordinarily these pictures do not show the occupants of a car.

Traffic engineers have developed numerous uses for vehicle counters in addition to simple enumeration. Methods have been worked out to chart the flow of traffic over a road net, giving results that may be useful to recreation administrators if the relationships between these flows and recreation visits can be defined. This technique has promise not only because so much forest recreation is car-related, but also because it might be tied into annual statewide flow charts prepared by the State Highway Department. This relationship might provide a basis for determining where



A recording traffic counter which prints on paper tape the total traffic flow during each hour of operation.



Traffic flow during pre-set time periods can be tallied by this type of counter.

the visitors to a particular national forest come from and also help establish historical trends useful for projecting future recreation use.

One system used to estimate traffic flow depends first on identifying the relevant road net and classifying it into use-classes or zones. Then these zones are systematically sampled with traffic counters at four kinds of locations. A few key places are counted continuously with interval recorders; "major control" points are counted for 5 days each month; four to six 2-day counts are made each year at "minor control" points; and one 2-day count a year is made at "coverage" points on little used roads. Some adaptation of this system could be applied to a unit as small as a national forest.

Two sampling techniques based on traffic counting may help estimate another factor--the amount of time vehicles stay in a recreation area. The first method estimates only total car hours; the second also delineates length of stay. On recreation sites with one-way traffic, the accumulated total entrances and exits are read at short intervals from conventional traffic counters. The accumulated number of entrances in a specific time, less exits during the same period, multiplied by the length of the interval, gives the approximate car-hours or car-minutes for that period. These figures are added up over the intervals in a day to produce total car-hours for the day. Vehicles are assumed to enter uniformly throughout the interval, or all at the end or beginning of the interval, whichever gives the least error. An appropriately timed daily reading might be used to estimate the number of cars in an area overnight. Interval printing counters or time sequence cameras can automatically record the required data, and time of entry and exit counters will give data for calculating the accumulated car-hours. Car-hours are converted to man-hours with a factor derived by subsampling vehicles and counting occupants.

The second method is a modification of the "cordon count" used by traffic engineers to determine traffic flow into and out of a city, and the time spent in the central area (1). The license number and time of entry are recorded for each vehicle, together with the number of occupants if this is possible. The same data are recorded upon exit of the vehicle. For cars with multiple entries, only the first and last record is considered. Data are accumulated this way to show the length of stay of each vehicle and party, and the number of cars. Where use is infrequent, as at a small campground or even at a large one during the week, where it is inefficient to station an attendant, sample cordon counts or automatic cameras might help.

## Use of Selected Services

Because certain facilities are basic to human existence, measurement of their use may reflect the intensity of recreation activity. Water consumed, garbage and trash collected, and toilet usage may be sufficiently well correlated with man-days of use to be cheap and consistent measures of recreation. If not used as a basic record, these measures might be useful checks on other estimates.

Garbage and trash are collected from most occupancy sites and the weight or volume might be measured. Each can could be weighed as it is loaded, or the truck could be weighed empty and full. Portable or platform scales are available, and a new electronic device weighs a truck in motion. The volume of trash can be estimated in the cans or by the truck load.

Water is piped to many camp and picnic grounds and this offers the chance to measure its use. Meters can be installed and read periodically or recorded by automatic time-sequence devices. Meters are available to record at a central point the water use at a remote locality.

The amount of toilet use can be judged in several ways. Users can be recorded by foot traffic counters or door swing counts. The weight of sludge removed from vaults can also be measured. Volume can be metered, or the number of truckloads counted, or the truck can be weighed. Volume can also be approximated by measuring rods when the container dimensions are known.

None of these indirect counting systems measures the length or number of recreation visits. They are chiefly valuable for estimating man-days, or intensity, of recreation use. Conversion factors must be applied to get any other measures from them. Although the indirect measuring devices are fairly simple and little labor is required to operate them, it is difficult to assess the reliability of each measure derived by indirect counting. Before it can be used in a particular situation, any indirect counting system must be tested to determine whether usable correlations exist between the counts obtained from it and the recreation-use data required for national forest administration.

## FUTURE RESEARCH

Obviously more research is needed before any final judgment can be formed about the desirability of various recreation-use measures and systems. Methods must be tested, statistics must be evaluated, and the national forests must be calibrated in terms of recreation use.

## TESTING METHODS OF MEASUREMENT

The work needed in the general field of methods might build on the techniques reported in this paper. The objective is to define the most effective ways of applying each method of measuring recreation use to field situations, and to evaluate the results that can be expected. Work can be divided into the following studies:

a. Description of the recreation sites and areas found on typical national-forest ranger districts and description of the activities at each site.

b. Selection of alternative measurement methods most likely to give satisfactory results in a typical situation, considering the physical characteristics and activities previously described.

c. Determination of the special conditions needed to test these various alternatives, and selection of pilot districts where these test facilities can be obtained.

d. Completion of the selected tests in one season. These field tests should indicate the correlations that exist between the items measured and recreation use, biases inherent in each method, measures of accuracy, consistency that can be achieved, problems and costs of operation.

e. Conduct of special tests, as needed, to determine efficient methods of deriving necessary conversion factors such as averages for the number of people per car or party, length of stay, multiple exits and entrances, number of trailers, and number of vehicles per party.

f. Estimation of patterns of recreation use characteristic of individual recreation sites and areas. Hourly, daily, and seasonal patterns will help in the design of systems for sampling use. These patterns of use, within and among recreation sites, can also suggest the preferences that users have for the specific facilities. In addition, it will also be possible to use these data to work out central compilation methods. Machine methods may not only simplify bookkeeping, but also provide a way of rapidly deriving trends in use over time.

g. Summarization of the data from these various tests and analysis of the costs and results of measurement methods to rate their desirability for use at any particular recreation site or area.

## EVALUATING RECREATION STATISTICS

Although evaluation of presently used recreation measurements might logically precede the testing work, enough is already known so that the two phases of research can be studied concurrently. The object of evaluation is to define the purposes served by various measures of recreation and thus define the characteristics such measures should have in order to be most useful for national-forest recreation planning and administration.

a. The first area of investigation might include a study of the way present measures are used at various administrative levels. Obviously a variety of management purposes are served, for each of which some data are more important than others. Although no one unit of measure is equally satisfactory for all purposes, the data currently collected may be susceptible to considerable improvement in unit, in accuracy, or in consistency. The consistency of data over time, for example, may be more important than absolute accuracy for some administrative planning purposes, while for others accuracy is essential.

b. With the desirable characteristics of each statistic understood, and the feasibility and cost of collection outlined, an analysis of alternative measurements can be made. This should include an evaluation of each possible measure so that administrators can select the statistics that most efficiently meet their needs.

## CALIBRATING NATIONAL FORESTS

After data-gathering methods have been tested and statistics have been evaluated, a third phase of research is needed to bring them together in suitable combinations and to set up an efficient system of providing the desired set of recreation measurements. The problem is to devise methods of calibrating all recreation use on large forest areas, such as a national forest, so that the mensurational devices and procedures will be selected and operated as efficiently as possible.

This phase of research should emphasize the method of calibrating a forest--tailoring a system to fit the forest rather than imposing a predetermined system. Thus intensive work might be required in the first year to establish patterns of recreation use on the forest and identify the key observations to be made. In the second year the use of key measures alone, with only enough extra measures to check the consistency of patterns, should provide a first approximation of the system's efficiency and adequacy. Thereafter, if the system's design proves satisfactory, only minor adjustments may be necessary to gain greater efficiency. However, even when calibration is completed and the system becomes fully operational, provision should be made to re-calibrate from time to time to insure that key measures continue to reflect the current recreation-use pattern in the most efficient way.

This study of calibrating methods should aim at systems that not only produce data of known accuracy consistently, but also will provide local specialized information as needed. Flexibility to meet peculiar forest or regional requirements, without sacrificing broader objectives, should be an important part of any method developed.

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USDA-FOREST SERVICE

# RECREATION VISITS – ANNUAL STATISTICAL REPORT

FILE REFERENCE: 1380 (2300)

A. CALENDAR YEAR: 1959

| B. STATE | C. REGION | D. FOREST | E. DISTRICT |
|---|---|---|---|
| California, Nevada, and Oregon | 5 | All | - |

| ITEM | RECREATION SITES AND AREAS | USERS OF RECREATIONAL RESOURCES | | |
|---|---|---|---|---|
| | | Number of visits | Number of man-days | Average length of visit |
| (1) | (2) | (3) | (4) | (5) |
| 1 | Campgrounds | 2,203,606 | 7,348,333 | 3-1/4 |
| 2 | Picnic Sites | 1,734,823 | 1,272,320 | 3/4 |
| | Sub-Total | 3,938,429 | 8,620,653 | 2-1/4 |
| 3 | Winter Sports Sites | 1,508,700 | 1,344,380 | 1 |
| 4a | Organization Camps owned by Forest Service | 12,350 | 43,925 | 3-1/2 |
| 4b | Organization Camps not owned by Forest Service | 246,870 | 1,522,460 | 6-1/4 |
| 5a | Hotels or Resorts owned by Forest Service | - | - | - |
| 5b | Hotels or Resorts not owned by Forest Service | 601,290 | 1,488,140 | 2-1/2 |
| 6 | Recreation Residences | 342,932 | 2,767,376 | 8 |
| 7 | Wilderness Areas | 179,150 | 530,063 | 3 |
| 8 | Other Forest Areas | 6,726,980 | 7,134,983 | 1 |
| | GRAND TOTAL *(Sub-total and + items 3 - 8 incl.)* | 13,556,701 | 23,451,980 | 1-3/4 |

## PRIMARY PURPOSE OF VISITS BY USERS OF RECREATIONAL RESOURCES

| Primary purpose (6) | No. visits (7) | Primary purpose (6) | No. visits (7) |
|---|---|---|---|
| a. Camping | 1,168,650 | h. Canoeing | 329,508 |
| b. Picnicking | 2,228,166 | i. Organization Camping | 270,245 |
| c. Swimming | 536,680 | j. Wilderness Travel | 119,847 |
| d. Winter Sports | 1,416,400 | k. General Enjoyment & Sightseeing | 3,705,064 |
| e. Hunting – Big game Sub-Total; Small game Sub-Total | 930,187 | l. Gathering Forest Products for Pleasure | 67,186 |
| | | m. Scientific Study and Hobbies | 40,745 |
| f. Fishing | 1,976,134 | n. Other Activities | 320,086 |
| g. Hiking and Riding | 447,803 | TOTAL *(Items, a-n, incl.)* | 13,556,701 |

REMARKS *(Use reverse if necessary)*

APPENDIX

## COUNTING DEVICES

| Manufacturer and product | Results | Detection | Power supply | Approx. cost | Approx. weight |
|---|---|---|---|---|---|
| | | | | Dollars | Lbs. |
| **AIDS TO DIRECT OBSERVATION** | | | | | |
| **Hand Tallys** | | | | | |
| Veeder-Root, Inc. Hartford 2, Conn. | | | | | |
| Single counter | 4 place dials | Finger tip pressure on front | None required | 10 | .25 (per unit) |
| Vary-tally 1-72 unit mechanical counter | 4 place dials | | | 9 (per unit) | |
| The Denominator Co., Inc., 261 Broadway, New York 7, New York | | | | | |
| Hand tally counter (single or multiple) | 4 place dial | Finger pressure on spring cover | None | 5 (single) 7 (per unit of multiple type) | Nominal |
| **Punch Cards** | | | | | |
| International Business Machines | | | | | |
| Port-a-punch | Punched cards | Hand operated stylus | None | 2.50 (board) | |
| Mark sensing | Punched cards | Special marking pencil | | | |
| **TV and Cameras** | | | | | |
| Thompson Ramo-Woolridge Inc., Dage Television Div., West 10th Street Michigan City, Indiana | | | | | |
| Vidicon camera | Television image | Television camera | 115 AC | 1350-5000 | 42 |

APPENDIX

COUNTING DEVICES

| Manufacturer and product | Results | Detection | Power supply | Approx. cost | Approx. weight |
|---|---|---|---|---|---|
| | | | | Dollars | Lbs. |
| **TV and Cameras** | | | | | |
| Thompson Ramo-Woolridge Inc., continued | Monitor | | 115 AC | | 50 |
| Traffic Controls, Inc.<br>82 St. Paul Street<br>Rochester 4, New York | | | | | |
| Phototraffic camera | Photograph of vehicle, date, time, etc. | Pneumatic tube | | | |
| Taller and Cooper<br>75 Front Street<br>Brooklyn 1, New York | | | | | |
| Automatic camera | Photograph of vehicle, license no. etc. 16mm film | Treadle or electric eye | 110 AC<br>60 DC | | 50 |
| **INDIRECT MEASURES** | | | | | |
| **Vehicle Traffic Counters** | | | | | |
| Streeter-Amet Co.<br>Grayslake, Illinois | | | | | |
| Junior traffic counter | 5 place dial | Pneumatic tube, pressure pad | 115 AC<br>6 DC | 50 (complete) | 8.5 (complete) |
| Jr. modified | 5 place dial | Electrical closure treadle | 115 AC | | 35 |
| Period-control counter | 5 place dial | Pneumatic tube | 115 AC<br>6 DC | 165 (complete) | 12.5 (complete) |

APPENDIX

COUNTING DEVICES

| Manufacturer and product | Results | Detection | Power supply | Approx. cost | Approx. weight |
|---|---|---|---|---|---|
| | | | | Dollars | Lbs. |
| **INDIRECT MEASURES** | | | | | |
| **Vehicle Traffic Counters** | | | | | |
| Streeter-Amet Co.(cont.) | | | | | |
| RC or RCH traffic counter | 15 or 60 minute totals printed | Electrical contact treadle | 115 AC or 6 DC | 410 (complete) | 52 or 90 |
| Electric eye traffic counter | Print and reset each hour | Photoelectric eye | 115 AC | 985 (complete) | |
| K-Hill Signal Co., Inc. 326 W. 3rd Street Uhrichsville, Ohio | | | | | |
| Twin directional traffic counter | Two 5 place dials separate traffic by direction | Double pneumatic tube | DC or (110 AC w/ transformer) | 165 (less tube) | 18 |
| Total flow traffic counter | 5 place dial | Pneumatic tube | 6 DC | 45 50 | 10 |
| "One-way" directional and total flow | 5 place dial; can record either total flow or one-way flow | Pneumatic tube | 6 DC | 90 | 15 |
| Econolite 8900 Bellanca Avenue Los Angeles 45, California | | | | | |
| Graphic traffic counter | Circular chart | Pneumatic tube | 12-20 DC | 518 (complete) | 35 |

APPENDIX

## COUNTING DEVICES

| Manufacturer and product | Results | Detection | Power supply | Approx. cost | Approx. weight |
|---|---|---|---|---|---|
| | | | | Dollars | Lbs. |
| **INDIRECT MEASURES** | | | | | |
| **Vehicle Traffic Counters** | | | | | |
| Muni-Quip Corp.<br>989 W. King Street<br>Decatur, Illinois<br>Traffic counter | 5 place dial (re-settable) | Pneumatic tube | 12 DC | 85 (com-plete) | 10 |
| Eastern Industries, Inc.<br>Automatic Signal Div.<br>Norwalk, Connecticut<br>RD-1, RD-1a (Radar vehicle detector) | Output for counting | Radar | 115 AC | 372 | |
| General Railway Signal Co., Electronic Control Div., Rochester 2, New York<br>Chekar, SVDT-2 | Output to recording device | Ultra-sonic sound waves | 115 AC 40-70 W | 800 | 84 |
| Advanced Instrument Corp.<br>700 So. 4th Street<br>Richmond, California<br>Perfograph digital data recorder | Electro-magnetic perfora-ted paper tape | Input from detec-ting device | DC or AC | 400 (recorder only) | 5 (recorder only) |
| Fischer and Porter Co.<br>Hatboro, Pa.<br>Digital demand recorder | Punches out 5, 15, 30 or 60 minute totals | Input from detection device | 115 AC or battery | 285 (recorder only) | 22 |

APPENDIX

COUNTING DEVICES

| Manufacturer and product | Results | Detection | Power supply | Approx. cost | Approx. weight |
|---|---|---|---|---|---|
| | | | | Dollars | Lbs. |

INDIRECT MEASURES

Weighing

| | | | | | |
|---|---|---|---|---|---|
| Taller and Cooper<br>75 Front Street<br>Brooklyn 1, New York<br>Weightronic: ES 41, ES 51 | Graphical-weight each axle; digital; punch card | Platform with electronic detector of moving vehicle | AC | | |
| L. R. Murphy Scale Co.<br>1610-12 N. "C" Street<br>Sacramento 14, California<br>Portable motor truck scales | Weigh beam | Lever system | | 2612 | 7100 (shipping weight) |
| | Printed in pounds | Lever system | | 2905 | 11 |
| Martin Decker Corp.<br>3431 Cherry<br>Long Beach, California<br>Portable hydraulic scale axle | Weight read from dial | Hydraulic | None | 1500 | |
| Loadometer Corp.<br>1503 W. 41st St.,<br>Baltimore 11, Md.<br>Portable mechanical axle scale | Weight read from dials and summed | Portable small pad with lever system | None | 960 per pair | 82 each |

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